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Characterization of Garko and Kura Rice Husks

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ABSTRACT: *A characterization studies have been carried out on Garko and Kura rice husk samples from Kano state of Nigeria. The results of Garko and kura rice husk are Moisture content of 5. 90 and 5.30%; Ash content of 17.10 and 15.70; Silica 95.10 and 93.08; alumina 2.56 and 1.91%; Calcium Oxide 0.45 and 0.31. Other results are Garko has 12.86% Carbohydrate, 15.40 crude fibre, 73.91 fat extract and 0.45 protein. Other results of Kura husk are 9.90% Carbohydrate, 13.50 crude fibre, 71.17 fat extract and 0.52 protein. The coking results reveals that there were increasing weight loss as the temperature is increased. In some cases at higher and at longer period of time some constancy were observed, implying optimal ash content. From the studies carried out both rice husks samples have good properties for both agricultural and industrial applications. However, comparative basis, Garko rice husk possesses better agricultural and metallurgical properties than Kura rice husk.*

KEYWORDS : *Rice husk, Silica, metallurgical, Agricultural,*

I. INTRODUCTION

Rice (Oryza sativa) is a cereal plant belonging to the grass family. They are monocotyledonous like wheat, barely, maize etc. Rice is widely grown in many parts of Nigeria in states like Kano, Ebonyin, Plateau etc. The constituents of rice include bran, grain, endosperm and husk. Rice husks are a fibrous, non-digestible commodity, accounting for about 20% of the dried paddy on stalk [1]. Rice husk removal during rice processing, generates disposal problem due to less commercial interest. Also, handling and transportation of rice husk is challenging due to its low density. Rice husk is a great environment threat causing damage to land and surrounding area where it is dumped. Rice husks posses both organic and inorganic components. The organic components includes crude protein, carbonhydrates, lipid, lignin, vitamins and organic acids [2]. The inorganic constituents having ash as the major component which is between 13.2 to 29.0% of the weight of rice husk [3]. Rice husk is unusually high in ash compared to other biomass fuels The silica content is between 87 – 97% [4]. The other components of ash are K_2O, CaO, Fe_2O_3, P_2O_5, SO_3, Na_2O, MgO and Cl [5]. Majority of the husk are disposed usually by burning in the open field creating problem of pollution to human and entire environment. Suitability of rice husk to be used for different applications depends upon the physical and chemical properties of the husk such as ash content, silica content etc. Direct use of rice husk as fuel has been seen in power plants. Apart from its use as fuel, Rice husk finds its use as sources of raw material for synthesis and development of new phases and compounds.

Various factors which influence ash properties are incinerating conditions (temperature and duration), rate of heating, burning technique, crop variety and fertilizer used. The main aim of this work, is to characterized the two rice husk for possible industrial applications. Despite so many well established uses of rice husk, only little portion of rice husk produced is utilized in a meaningful way developing nations, the remaining part is allowed to burn in open air or dumped as a solid waste. The large number of industrial applications which rice husk can be put to use necessitated the desire to study Garko and Kura rice husk with a view of identifying the best way they can be put to use.

II. MATERIALS AND METHODS

2.1 Materials : The materials used for this project were rice husk from Garko and Kura in Kano state of Nigeria. The husks were collected in large quantities from the rice mills located in both towns. They were than taken to Kano were the test was carried out.

2.2 Experimentation

2.2.2 Leaching : 5%g of each of the sample was measured into a washed and oven dried 250 ml conical flask. 5 mole NaOH and NH_4OH (33% purity) were added separately into the conical flasks containing the samples. The conical flasks were left to stand for 2 hours before filtration is carried out.

2.2.1Coking : 10g of the sample were measured into stainless cups and charge into the furnace. They were then burnt at temperatures of 200^0C, 300^0C, 400^0C, 500^0C, 600^0C and 700^0C for time intervals of 1, 2, 3, 4, and 5 hours. After every hour at the selected temperature a cup was withdrawn and the weight lost measured.

III. RESULTS AND DISCUSSIONS

The results of the chemical analysis are shown on **Tables** 1 and 2; the result of leaching is shown on Table 3, while the result of the coking experiment is presented in figure 1 to 6. From the result obtained (Table 1) Garko husk had higher values of silica, Alumina and ash. As a source of Silica and Silicon compounds, rice husk a promising raw material source for a number of silicon compounds such as silicon carbide, silicon nitride, silicon tetrachloride, zeolite, silica, and pure silicon [6, 7]. Rice husk ash has been widely used in various industrial applications such as processing of steel, refractory industry etc. Suitability of rice husk ash mainly depends on the chemical composition of ash, predominantly silica content in it. Rice husk ash is found to be superior to other supplementary materials like slag, silica fume and fly ash [8]. Rice husk ash has been used as silica source for cordierite production. Replacement of kaolinite with rice husk silica in the mixture composition, yields higher cordierites with a lower crystallize temperature and decrease in activation energy of crystallization [9].Silica aerogels prepared from RHA finds application in super thermal insulators, catalyst supports and dielectric materials (Goncalves, 2007). Based on the above usage of silica in the various industries mentioned Garko husk is superior to Kura husk for industrial applications. Agriculturally also, Garko husk shows superiority in terms of the fat, carbonhydrate and crude fibre, hence will posses more nutritional value than Kura husk as seen on Table 2.

From the results of leaching it is deduced that the solvents had considerable influence on the rice husk samples. It means that each of the solvent leached out a certain percentage of the inorganic constituents alongside the organic matter that were previously leached out during the digestion process. Calcium oxide, silica and magnesia were considerable reduced by the action of all the solvents with H_2SO_4 and NaOH showed more evere reduction in the values of the three oxides than HNO_3, NH_4OH and HCl. Surprisingly, the value of FeO in all the media increased more than its original value in the chemical analyses results. These increases might have resulted from some chemical reactions between the media and the constituents may have led to the formation of FeO instead of its removal from the complex, thereby increasing its value in the residue. The result is corroborated by the colour changes noticed when the solvents were added to the husks

Table 1: Results of Chemical Analysis of Garko and Kura Rice Husks

Constituents	Garko Rice Husk	Kura Rice Husk
Moisture Content %	5.90	5.30
Ash Content %	17.10	15.70
Silica (SiO_2) %	95.10	93.08
Calcium Oxide (CaO) %	0.45	0.31
Ferric Oxide (FeO) %	0.18	0.19
Magnesia (MgO) %	0.41	0.46
Alumina (Al_2O_3) %	2.56	1.91

Table 2: Results of essential food content of Garko and Kura Rice Husks

Constituents	Garko Rice Husk	Kura Rice Husk
Carbonhydrate	12.86	5.90
Crude fibre	15.40	13.50
Fats extract	73.91	71.17
Protein	0.45	0.63

Table 3: Result of leaching experiment on Garko and Kura Rice Husks

Rice Husk Sample	Leaching Chemical	CaO	FeO	MgO	SiO_2
Garko	HCl	033	0.24	0.19	91.21
	HNO_3	0.35	0.25	0.19	91.58
	H_2SO_4	0.27	0.23	0.15	90.80
	NaOH	0.35	0.25	0.17	91.05
	NH_4OH	0.76	0.26	0.16	93.60
Kura	HCl	0.39	0.25	0.18	91.60
	HNO_3	0.42	0.26	0.20	91.60
	H_2SO_4	0.35	0.26	0.16	91.10
	NaOH	0.34	0.26	0.17	91.20
	NH_4OH	0.45	0.27	0.18	93.50

than HNO_3, NH_4OH and HCl. Surprisingly, the value of FeO in all the media increased more than its original value in the chemical analyses results. These increases might have resulted from some chemical reactions between the media and the constituents may have led to the formation of FeO instead of its removal from the complex, thereby increasing its value in the residue. The result is corroborated by the colour changes noticed when the solvents were added to the husks From Figure 1 to 6, clearly shows that weight loss increased with both coking time and coking temperatures. This is true since the higher the temperature, the higher the rate of volatilization of organic matter and the longer the holding time, the higher the rate of volatilization.

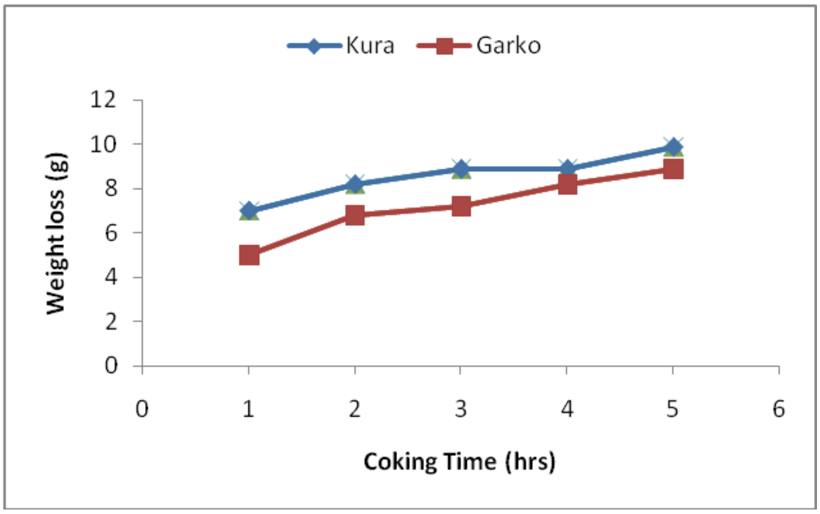

Figure 1: weight losses against coking time at 200^0C

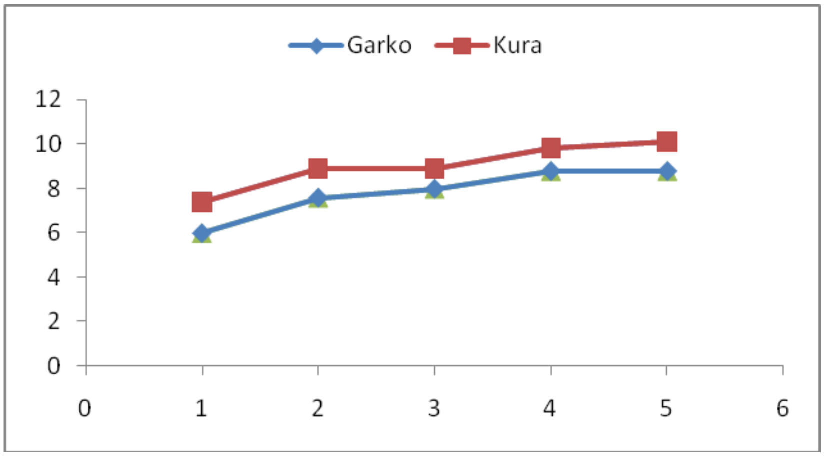

Figure 2: weight losses against coking time at 300^0C

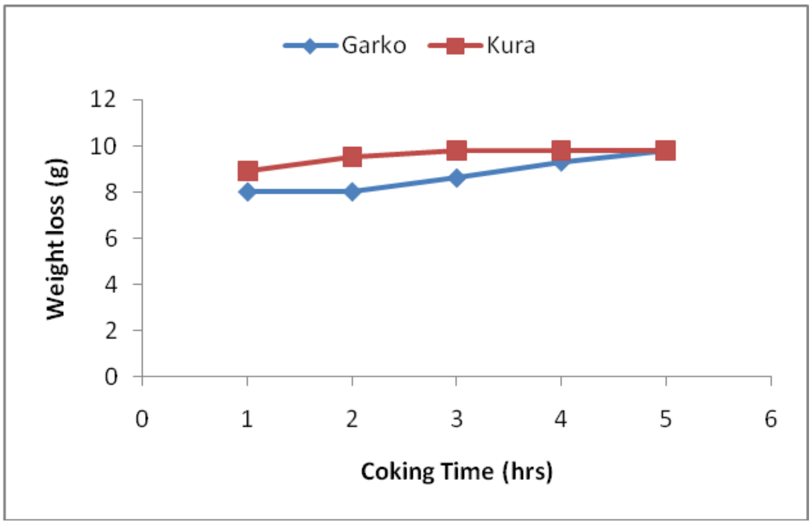

Figure 3: Weight losses against coking time at 400^0C

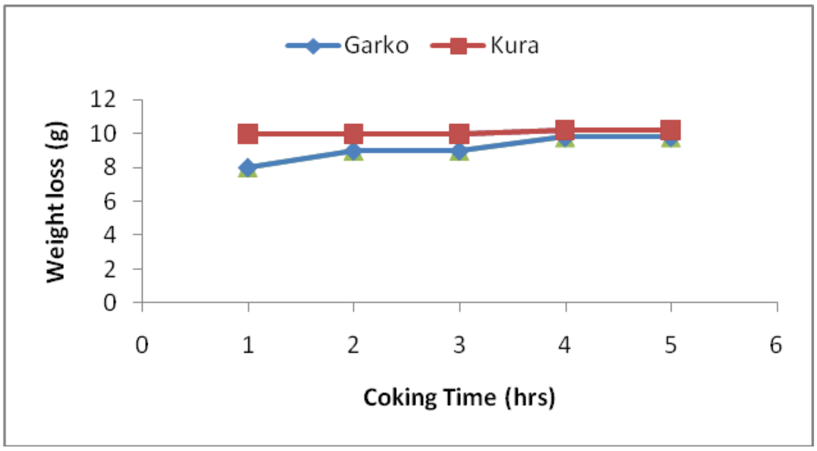

Figure 4: Weight losses against coking time at 500^0C

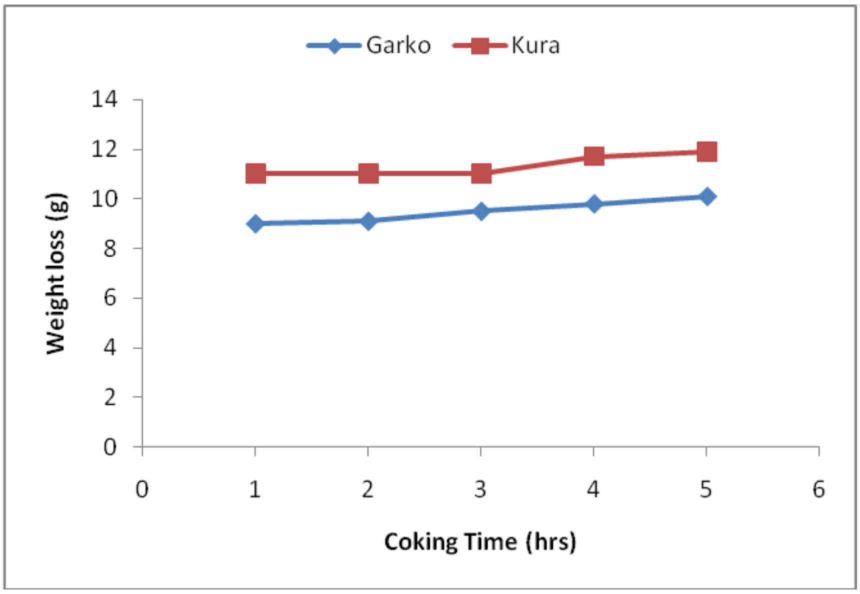

Figure 5: Weight losses against coking time at 600^0C

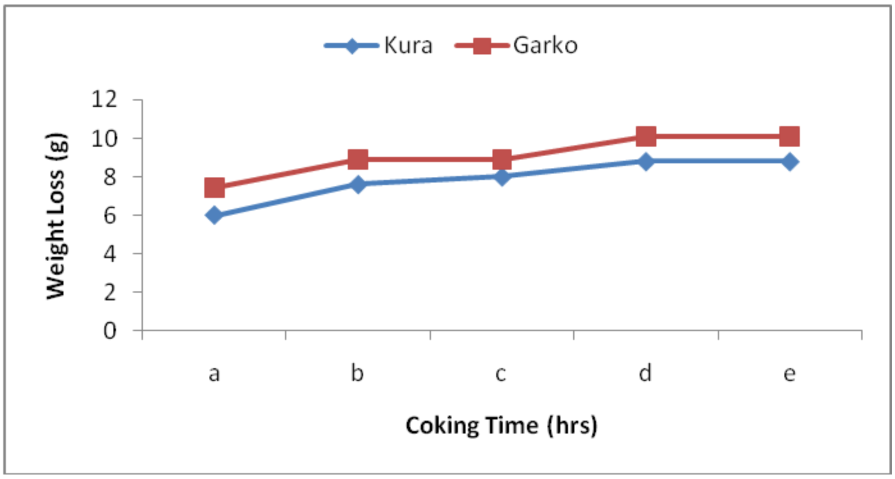

Figure 6: Weight losses against coking time at 700^{0}C

IV. CONCLUSION

Rice husk has been used directly or in the form of ash as a value added material for manufacturing and synthesizing new materials and as a low cost substitute material for modifying the properties of existing products. Presence of silica is an additional advantage in comparison to other byproduct materials which makes rice husk an important material for a wide range of manufacturing and application processes. From the study carried out Garko and Kura rice husk possesses the requirement for both agricultural and industrial applications. However comparing the two husk, Garko rice husk is best used in the metallurgical and materials industries because of its higher content of silica, alumina and ash. Agriculturally also Garko is better utilized than Kura husk because of higher content of fat extract, crude fibre and carbonhydrates value.

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